Answer any four questions   **Time: 2 hours**

1. Distinguish between the following terms, using only graphs and mathematical expressions to support your answers. Do not explain.

   a) Economic Efficiency and Pareto Efficiency
   b) Consumption efficiency locus and Production efficiency locus
   c) Utility Possibilities frontier and Grand Utility Frontier

2. a) Two companies A and B emit 20 units each of a certain pollutant. Imagine that the companies cleanup cost functions are $MC_A = q$ and $MC_B = 4q$ where q is the number of units removed from the emissions. The environmental authority wants to reduce total emission from 40 to 20 units. Prove with the use of graphs and calculations that the resource cost of pollution abatement are high with quantity control approach than that of tax approach.

   b) i) What happens if the tax is less than the cost per unit of cleaning up?
      ii) What happens if the tax is greater that the cost per unit of cleaning up?

3. a) Graphically compare the open access and private equilibrium in fishery.

   b) Suppose that the biological mechanics of a fishery is given by $F(X) = 10X - 4X^2$
      Where X is the stock of fish in million metric tons. Calculate the fallowing:
      i) What is the stock at carrying capacity? and
      ii) What is the stock at Maximum Sustainable Yield.

4. a) Write the Faustsman formula for optimal harvesting time of forest and explain the economic intuition behind it.

   b) Explain the optimal rotation sensitiveness to changes in
      i) cost of harvesting,
      ii) distance to sawmills, and
      iii) other benefits such as non timber values.

5. Write short notes on any two of the following:

   a) Externalities and The Coasian Market Solutions
   b) Hotelling Rule and Backstop technology
   c) Coastal Protection Value of Coastal Ecosystems and the Threat Analysis.